

0890

KEYSTONE

WOOD WORKING
TOOLS



PHELPS BROS. MFG. CO.
PITTSTON, PA.



PARSONAGE ST.
"PHELPS. PITTSTON PA."



MONOTYPED & PRINTED
BY
LABARRE PTG. CO.
W. PITTSTON, PA.

TO THE TRADE

Each article in this catalog is designated by a figure or stock number. Please do not cut or deface this book. Always order tools by figure number.

We try and take pains to have everything right and satisfactory to our customers, and if it is otherwise, we are more than willing to correct it.

We prepay the postage or express on all our tools.

You may send post office or express money orders, or personal checks, or we can send any order by parcel post, C. O. D., for ten cents extra.

We will accept stamps for any small order.

Your attention is called to the useful tables in the back part of this booklet.

Small Spoke Shaves

We present here a line of shall brass and aluminum spoke shaves, all of which, we think, are new to the trade, and some of them designed for special purposes. Originally intended for pattern-makers' use, but used also by carpenters, cabinet makers, amateurs and in manual training work.

These tools are made either of aluminum or brass, polished. We recommend the brass for the smaller sizes. The aluminum used in these and the other tools is a special alloy, slightly heavier than the pure article, strong and with good wearing qualities.

When ordering one spoke shave separately in any of the following styles, always state whether a round or flat bottom is wanted.

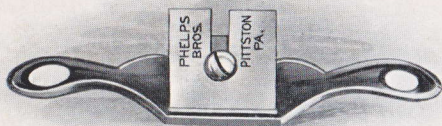


Fig 1200

Fig. 1200—Small Spoke Shaves

Length over all 4 inches

Width of blades $\frac{1\frac{5}{8}}{1\frac{1}{8}}$ inches

Made of brass, polished. Raised handles. Made with both round and flat bottoms.

Price each \$

Per pair, one round and one flat bottom

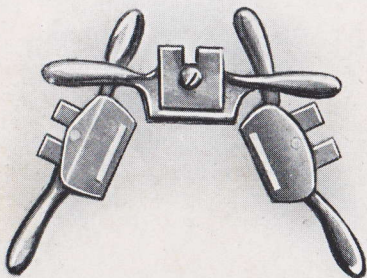


Fig. 1201—Small Spoke Shaves

Length, over all $3\frac{5}{8}$ inches

Width of Blades $\frac{3}{4}$ inches

Made with both round and flat bottoms. Made of brass, nicely polished.

Prices same as following style.

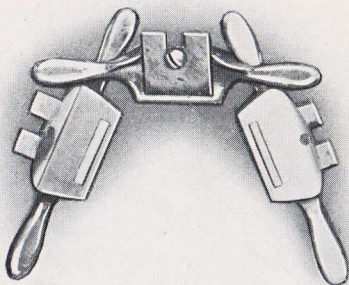


Fig. 1202—Small Spoke Shaves

Nearly the same as fig. 1201, except that they are made somewhat heavier, and with a wider blade. Made of brass polished.

Length, over all	$3\frac{3}{4}$ inches	
Width of blades	$1\frac{3}{16}$ inches	
Price, each	\$	50
Per pair, one round and one flat bottom . . .		90

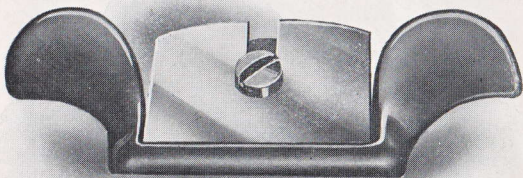


Fig. 1203—Short Handled Spoke Shaves

A very popular mod l. The shape provides a handy and comfortable grip. Made of brass, polished. Made with both round and flat bottoms, for concave and convex work. Furnished in two sizes with either $\frac{7}{8}$ in. or $1\frac{3}{16}$ in. cutters. Cut shows full size of the largest or No. 2.

Price, No. 1, with $\frac{7}{8}$ in. blades, each	\$	50
Per pair, (one round and one flat bottom) . . .		90
Price, No. 2, with $1\frac{3}{16}$ in. blades, each		50
Per pair (one round and one flat bottom) . . .		90

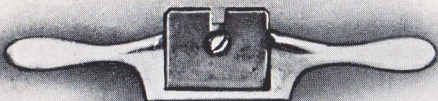


Fig. 1204



Fig. 1205

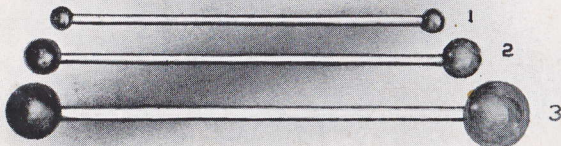


Fig. 1206

Fig. 1204—Spoke Shaves (Medium)

Length, over all $5\frac{1}{4}$ inches

Width of blade $1\frac{1}{4}$ inches

Bottoms slightly rounded.

Price, each, either aluminum or brass

Fig. 1205—Wood-Workers Bench Knife

Fine for laying out work and for carving. Handles are 4 in. long. Brass frames, inlaid with fancy hard wood. The blades extend entirely through handles and may be drawn out as they are worn back, and when used up, may be replaced with a new blade. Blades are of the best special carbon tool steel, tempered their whole length.

Sent post-paid.

Price, each, complete with blade \$1.00

Extra blades for above knife25

Fig. 1206—Fillet Tools

Made of ball bearings.

Price—No. 1, with $\frac{1}{4}$ in. and $\frac{5}{16}$ in. balls . . . \$.25

Price—No. 2, with $\frac{3}{8}$ in. and $\frac{1}{2}$ in. balls25

Price—No. 3, with $\frac{5}{8}$ in. and $\frac{3}{4}$ in. balls35

Price—Per set of 3 sizes, postage paid85

Price—No. 4, with $\frac{7}{8}$ in. and 1 in. balls50

Price—Per set of 4 sizes, postage paid . . . \$ 1.25

Following are three special Spoke Shaves made with bottoms rounding both from front to back and from right to left. Intended for hollow work such as elbow core-boxes; core-boxes for centrifugal pumps, and many other purposes of this character.

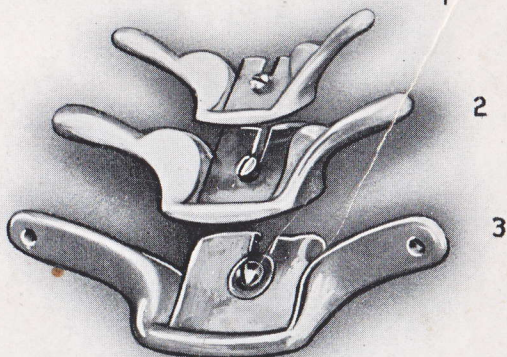


Fig. 1207—Small Size, No. 1

Length over all $3\frac{7}{8}$ inches
 Width of blade $\frac{7}{8}$ inches
 Bottoms rounded to about $4\frac{1}{2}$ inch circle.

Price, each, either aluminum or brass, . . . 50c.
 Postage paid.

Fig. 1207—Medium Size, No. 2

Length, over all $5\frac{1}{4}$ inches
 Width of blade $1\frac{1}{4}$ inches
 Bottoms rounded to about $6\frac{1}{2}$ inch circle.

Price, each, either aluminum or brass, . . . 60c.
 Postage paid.

Fig. 1207—Large Size, No. 3

Length, over all $6\frac{1}{2}$ inches
 Width of blade 2 inches
 Bottoms rounded to about $10\frac{1}{2}$ inch circle.

Price, each, either aluminum or brass, . . . 70c.
 Postage paid.

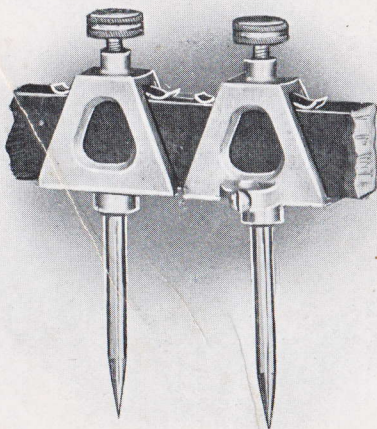


Fig. 1208—Trammel Points

Here are a complete line of new style tram-
mels. Being provided with a spring they are al-
ways held steady and with a certain degree of
pressure to the wood beam on which they are
used, making them very easy to adjust and to set.
When they are adjusted to the proper position,
the spring holds them in place while they are
made fast with the thumb screw.

Made of aluminum, nicely polished, are light
yet strong. Steel points of ample length, each
pair provided with pencil socket.

Made in five sizes, as follows:

No.	Size of Wood Beam	Price
1.....	$\frac{1}{4}$ x $\frac{1}{2}$ inches.....	\$.75
2.....	$\frac{3}{8}$ x $\frac{3}{4}$ inches.....	.85
3.....	$\frac{7}{8}$ x 1 inches.....	.95
4.....	$1\frac{1}{2}$ x $1\frac{1}{4}$ inches.....	1.30
5.....	$2\frac{1}{8}$ x $1\frac{1}{2}$ inches.....	1.25

Postage paid.

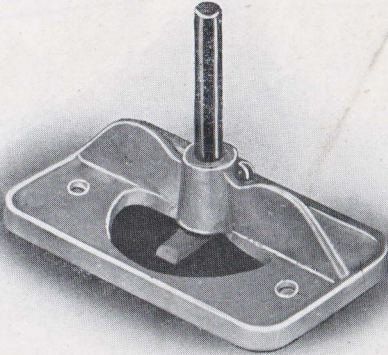


Fig. 1209—Router Plane

This tool should be in the kit of every pattern-maker, carpenter, cabinet maker, or other wood-worker; is small in size, measuring $2\frac{1}{2} \times 4\frac{1}{2}$ inches; bottom surface accurately machined; provided with screw holes whereby wood extension may be secured to the bottom, adapting the tool to smooth the bottoms of wide depressions below the general surface of any wood work. Made of either aluminum or brass, we recommend the aluminum as it is very light weight. Provided with $\frac{5}{16}$ inch steel cutters.

Price, each, either aluminum or brass, 75c.
Postage paid.

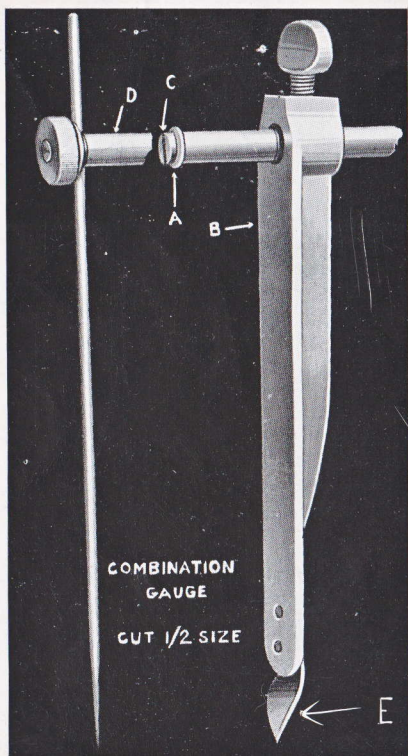


Fig. 1210—Combination Gauge

Fig. 1210—Combination Gauge

Aluminum body, steel beam and pin, each about seven inches long.

This tool is used for a number of purposes. First; as a **Regular Gauge**, the hardened-steel marking roller (A) is adapted for gauging lines either with the grain, across the grain, or upon the end grain of wood.

The body of the tool (B) being narrow, the tool can be used upon either a flat, concave, or convex surface. The end of the beam (C) being flat; is used as a **Depth Gauge**. The beam is reversible, when reversed the **Scriber Gauge** is brought into use as shown (at D) all P. M's. will see at a glance how this arrangement is useful for gauging lines over and beyond ribs, and other obstructions; also as a **Surface Gauge**.

The **End Scriber** shown (at E) is flush with the face of the tool, and, with the aid of a square edged board, is used for drawing lines across core boxes, etc.

Many other uses will be suggested to the user of one of these tools.

Sent to any address postage paid, upon receipt of price. Your money refunded if not entirely satisfactory.

Price, each, 85c

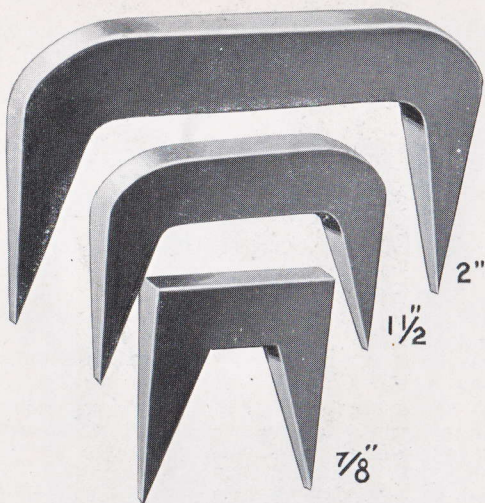


Fig. 1211—Forged Steel Pinch Dogs
 (Improved Style)
 (Cut shows full size)

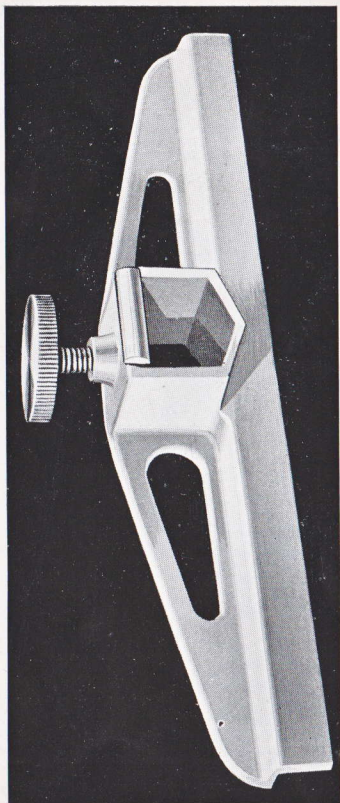
These are the only Pinch Dogs that give entire satisfaction

These dogs are made perfectly interchangeable, so that when any one of a size has been driven into the wood and withdrawn, any other one of that size will go into the same place, thereby saving the making of more holes in the pattern or other woodwork. Pattern Makers will appreciate what this means.

Our dogs are hardened slightly so that they will not bend easily.

We sell direct from the maker to the user, so that we are able to furnish you these tools for just about half what you would have to pay elsewhere for **steel** dogs that don't come up to ours.

Price,	$\frac{7}{8}$ inch	\$.75 per dozen.
	$1\frac{1}{2}$ inch	.85 per dozen.
	2 inch	1.00 per dozen.
	3 inch	1.50 per dozen.



**Fig. 1212—Panel Gauge
(Nichols Pattern)**

Notice the shape of the hole provided for the beam. This shape is such that when the tool is set at any point, and the thumb-screw tightened, it is impossible for the beam to be moved sideways.

The tool is accurately machined. Is 8 inches long. Made of brass. Each tool is warranted. Will be sent anywhere, postage paid, for the price. Price, each.....85c

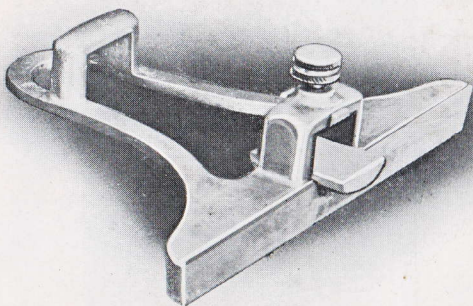


Fig. 1213—Panel Gauge

Made entirely of aluminum. Furnished without beam as many desire to make their own beams of a length to suit their particular work. Suitable for gauging a line upon either flat, concave or convex work. Postage paid.

Length, $6\frac{3}{4}$ ins. Size of beam, $\frac{1}{2} \times 1$ ins.

Price, each\$.85

Fig. 1214—Small Lathe Chuck

For holding rods from $\frac{1}{4}$ in. to 1 in. square, chuck being provided with R. and L. H. threads. The sticks are automatically centered and gripped tight.

Price, each\$ 1.25

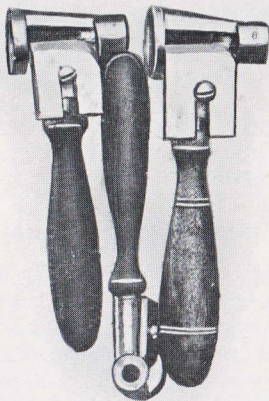


Fig. 1215—Dowel Pin Cutters

These are very handy tools for making round rods of wood for pins, dowels or any other purpose. One end of square stick is placed in lathe and the tool is started on opposite end of stick and moved toward chuck as fast as knife will feed. Makes a perfectly round, smooth and straight dowel. Each tool has range of adjustment for making either loose or tight fitting pins. The blade is set at such an angle that a shearing cut is secured. The wear upon the blade is reduced to a minimum, consequently the blade stays sharp much longer, and at the same time cuts very smooth. Being flat, the blades are easily sharpened. These tools are made of brass, polished, with hard-wood handles. Furnished in sizes in 8th and 16th of inch. from $\frac{1}{4}$ to $\frac{3}{4}$ inches.

Prices: $\frac{1}{4}$ and $\frac{3}{8}$ inch, each\$.80
$\frac{1}{2}$ inch, each85
$\frac{5}{8}$ and $\frac{3}{4}$ inch, each90
Set of 3 sizes: $\frac{1}{4}$, $\frac{3}{8}$ and $\frac{1}{2}$ inch 2.25

Price, set of five sizes:

$\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$ and $\frac{3}{4}$ inch 4.00
Set of above 5 sizes, with chuck described on next page 5.00
Sizes in 16ths of inch take price of next larger size.	

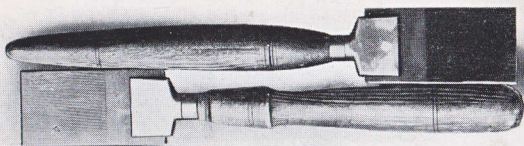


Fig. 1216—Tooth-Plane Turning Tool

Nothing better than these for wood-turning, making fine glue joints, truing large face-plates, segment work and for truing flat surfaces of all kinds. Genuine Peugeot Freres (French) blades, 2 in. wide, securely fitted to polished hard-wood handles. Length over all about 13½ inches.

Price, each.....\$ 1.25

If by mail, postage extra

Fig. 1225—Small Scratch Gauge

Pin about 5 inches long.

Price.....\$.50

Fig. 1226—Steel Glue Scraper

Securely fastened to hard-wood handle.

Price.....\$.65

TABLE FOR ROUNDING CORNERS.

		1.	2.	3.
		$\frac{37}{64}$	$1\frac{11}{64}$	$1\frac{49}{64}$
$\frac{1}{8}$	$\frac{5}{64}$	$\frac{21}{64}$	$1\frac{1}{4}$	$1\frac{53}{64}$
$\frac{1}{4}$	$\frac{9}{64}$	$\frac{47}{64}$	$1\frac{5}{16}$	$1\frac{29}{32}$
$\frac{3}{8}$	$\frac{7}{32}$	$\frac{51}{64}$	$1\frac{13}{32}$	$1\frac{31}{64}$
$\frac{1}{2}$	$\frac{9}{32}$	$\frac{7}{8}$	$1\frac{15}{32}$	$2\frac{3}{64}$
$\frac{5}{8}$	$\frac{23}{64}$	$\frac{61}{64}$	$1\frac{35}{64}$	$2\frac{1}{8}$
$\frac{3}{4}$	$\frac{7}{16}$	$1\frac{1}{32}$	$1\frac{5}{8}$	$2\frac{3}{16}$
$\frac{7}{8}$	$\frac{33}{64}$	$1\frac{3}{32}$	$1\frac{45}{64}$	$2\frac{17}{64}$

To round corners of any radius from $\frac{1}{4}$ in. to $3\frac{5}{8}$ ins., gauge lines the distance given in table for that size corner upon both sides from edge, and flatten the corner down to these lines, then round off the remaining small fins.

The table, No. 2, of distances across corners of squares, hexagons and octagons will be found useful by reason of the fact that, having the distance given across the flat parts of the different shaped pieces, the size is given opposite that a piece must be first turned to, to form a 4, 6 or 8 sided piece.

DISTANCE ACROSS CORNERS

SQUARE, HEXAGON & OCTAGON

Flats. Hex. Oct. Square. Flats. Hex. Oct. Square

$\frac{1}{4}$	$\frac{19}{64}$	$\frac{11}{32}$	$\frac{23}{64}$	$1\frac{3}{16}$	$1\frac{3}{8}$	$1\frac{37}{64}$	$1\frac{11}{16}$
$\frac{5}{16}$	$\frac{23}{64}$	$\frac{27}{64}$	$\frac{29}{64}$	$1\frac{1}{4}$	$1\frac{29}{64}$	$1\frac{21}{32}$	$1\frac{49}{64}$
$\frac{3}{8}$	$\frac{7}{16}$	$\frac{1}{2}$	$\frac{17}{32}$	$1\frac{5}{16}$	$1\frac{33}{64}$	$1\frac{3}{4}$	$1\frac{55}{64}$
$\frac{7}{16}$	$\frac{1}{2}$	$\frac{37}{64}$	$\frac{5}{8}$	$1\frac{3}{8}$	$1\frac{37}{64}$	$1\frac{27}{32}$	$1\frac{31}{32}$
$\frac{1}{2}$	$\frac{37}{64}$	$\frac{21}{32}$	$\frac{23}{32}$	$1\frac{7}{16}$	$1\frac{21}{32}$	$1\frac{59}{64}$	$2\frac{1}{32}$
$\frac{9}{16}$	$\frac{21}{32}$	$\frac{3}{4}$	$\frac{13}{16}$	$1\frac{1}{2}$	$1\frac{47}{64}$	2	$2\frac{1}{8}$
$\frac{5}{8}$	$\frac{47}{64}$	$\frac{27}{32}$	$\frac{7}{8}$	$1\frac{9}{16}$	$1\frac{13}{16}$	$2\frac{3}{32}$	$2\frac{7}{32}$
$\frac{11}{16}$	$\frac{51}{64}$	$\frac{59}{64}$	$\frac{31}{32}$	$1\frac{5}{8}$	$1\frac{57}{64}$	$2\frac{5}{32}$	$2\frac{15}{64}$
$\frac{3}{4}$	$\frac{7}{8}$	1	$1\frac{5}{64}$	$1\frac{11}{16}$	$1\frac{61}{64}$	$2\frac{1}{4}$	$2\frac{13}{32}$
$\frac{13}{16}$	$\frac{15}{16}$	$1\frac{7}{64}$	$1\frac{5}{32}$	$1\frac{3}{4}$	$2\frac{1}{32}$	$2\frac{21}{64}$	$2\frac{15}{32}$
$\frac{7}{8}$	$1\frac{1}{64}$	$1\frac{5}{32}$	$1\frac{15}{64}$	$1\frac{13}{16}$	$2\frac{3}{32}$	$2\frac{27}{64}$	$2\frac{9}{16}$
$\frac{15}{16}$	$1\frac{7}{64}$	$1\frac{15}{64}$	$1\frac{21}{64}$	$1\frac{7}{8}$	$2\frac{11}{64}$	$2\frac{1}{2}$	$2\frac{21}{32}$
1	$1\frac{5}{32}$	$1\frac{21}{64}$	$1\frac{27}{64}$	$1\frac{15}{16}$	$2\frac{1}{4}$	$2\frac{37}{64}$	$2\frac{3}{4}$
$1\frac{1}{16}$	$1\frac{1}{4}$	$1\frac{27}{67}$	$1\frac{1}{2}$	2	$2\frac{5}{16}$	$2\frac{21}{32}$	$2\frac{27}{32}$
$1\frac{1}{8}$	$1\frac{19}{64}$	$1\frac{1}{2}$	$1\frac{19}{32}$				

FLATS OF HEX. X 1.155 = CORNERS.

" " SQUARE X 1.414 = " "

No.	Decim.	Frac'n.	Size	Nearest
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No.	Size Decim.	Nearest Frac'n.
0	.0578	
1	.0710	
2	.0842	
3	.0973	$\frac{3}{32}$
4	.1105	$\frac{7}{64}$
5	.1236	$\frac{1}{8}$
6	.1368	$\frac{9}{64}$
7	.1500	$\frac{5}{32}$
8	.1631	
9	.1763	$\frac{11}{64}$
10	.1894	$\frac{3}{8}$
11	.2026	$\frac{13}{64}$
12	.2158	$\frac{7}{32}$
13	.2289	
14	.2421	$\frac{15}{64}$
15	.2552	$\frac{1}{4}$
16	.2684	$\frac{17}{64}$
17	.2816	$\frac{9}{32}$
18	.2947	$\frac{19}{64}$
20	.3210	$\frac{2}{5}$
22	.3474	$\frac{11}{32}$
24	.3737	$\frac{3}{8}$
26	.4000	$\frac{13}{32}$
28	.4263	$\frac{27}{64}$
30	.4520	$\frac{3}{2}$

8THS.	32	=.28125	19	=.296875
$\frac{1}{8}$	31	=.34375	18	=.328125
$\frac{1}{4}$	30	=.40625	17	=.359375
$\frac{3}{8}$	29	=.46875	16	=.390625
$\frac{1}{2}$	28	=.53125	15	=.421875
$\frac{5}{8}$	27	=.59375	14	=.453125
$\frac{3}{4}$	26	=.65625	13	=.484375
$\frac{7}{8}$	25	=.71875	12	=.515625
	24	=.78125	11	=.546875
16THS.	23	=.84375	10	=.578125
$\frac{1}{16}$	22	=.90625	9	=.609375
$\frac{1}{8}$	21	=.96875	8	=.640625
$\frac{1}{4}$	20		7	=.671875
$\frac{1}{2}$	19		6	=.703125
$\frac{3}{4}$	18		5	=.734375
	17		4	=.765625
	16		3	=.796875
	15		2	=.828125
	14		1	=.859375
32NDS.	13			=.890625
$\frac{1}{32}$	12	=.03125		=.921875
$\frac{1}{16}$	11	=.0625		=.953125
$\frac{1}{8}$	10	=.125		=.984375
$\frac{1}{4}$	9	=.25		
$\frac{1}{2}$	8	=.5		
$\frac{3}{4}$	7	=.75		
	6	=.1		
	5	=.2		
	4	=.3		
	3	=.4		
	2	=.5		
	1	=.6		

Circumference of Circle equals the diameter x 3.1416.
To find area of circle, multiply square of diameter by .7854
To find volume of a sphere, multiply cube of dia. by .5236.

TABLE SHOWING THE NUMBER OF SQUARE FEET IN BOARDS

		WIDTH IN INCHES																			
		WIDTH IN INCHES																			
	LENGTH IN FEET	WIDTH IN INCHES																			
		10"	20"	30"	40"	50"	60"	70"	80"	90"	100"	110"	120"	130"	140"	150"	160"	170"	180"	190"	200"
6"	6"	1'0"	2'0"	3'0"	4'0"	5'0"	6'0"	7'0"	8'0"	9'0"	10'0"	11'0"	12'0"	13'0"	14'0"	15'0"	16'0"	17'0"	18'0"	19'0"	20'0"
7"	6"	1'6"	3'0"	4'6"	6'0"	7'6"	9'0"	10'6"	12'0"	13'6"	15'0"	16'6"	18'0"	19'6"	21'0"	22'6"	24'0"	25'6"	27'0"	28'6"	30'0"
8"	7"	1'3"	2'6"	4'0"	5'4"	6'8"	8'2"	9'6"	11'0"	12'4"	13'8"	15'2"	16'6"	18'0"	19'4"	20'8"	22'2"	23'6"	25'0"	26'4"	27'8"
9"	8"	1'4"	2'8"	4'2"	5'6"	7'0"	8'4"	9'8"	11'2"	12'6"	14'0"	15'4"	16'8"	18'2"	19'6"	21'0"	22'4"	23'8"	25'2"	26'6"	28'0"
10"	9"	1'6"	3'0"	4'6"	6'0"	7'6"	9'0"	10'6"	12'0"	13'6"	15'0"	16'6"	18'0"	19'6"	21'0"	22'6"	24'0"	25'6"	27'0"	28'6"	30'0"
11"	10"	1'8"	3'2"	4'8"	6'4"	8'0"	9'6"	11'2"	12'8"	14'4"	16'0"	17'6"	19'2"	20'8"	22'4"	24'0"	25'6"	27'2"	28'8"	30'4"	32'0"
12"	11"	1'10"	3'4"	5'0"	6'6"	8'2"	9'8"	11'4"	13'0"	14'6"	16'2"	17'8"	19'4"	21'0"	22'6"	24'2"	25'8"	27'4"	29'0"	30'6"	32'2"
13"	12"	2'0"	3'6"	5'2"	6'8"	8'4"	10'0"	11'6"	13'2"	14'8"	16'4"	18'0"	19'6"	21'2"	22'8"	24'4"	26'0"	27'6"	29'2"	30'8"	32'4"
14"	13"	2'2"	3'8"	5'4"	7'0"	8'6"	10'2"	11'8"	13'4"	15'0"	16'6"	18'2"	19'8"	21'4"	23'0"	24'6"	26'2"	27'8"	29'4"	31'0"	32'6"
15"	14"	2'4"	4'0"	5'6"	7'2"	8'8"	10'4"	12'0"	13'6"	15'2"	16'8"	18'4"	20'0"	21'6"	23'2"	24'8"	26'4"	28'0"	29'6"	31'2"	32'8"
16"	15"	2'6"	4'2"	5'8"	7'4"	9'0"	10'6"	12'2"	13'8"	15'4"	17'0"	18'6"	20'2"	21'8"	23'4"	25'0"	26'6"	28'2"	29'8"	31'4"	33'0"
17"	16"	2'8"	4'4"	6'0"	7'6"	9'2"	10'8"	12'4"	14'0"	15'6"	17'2"	18'8"	20'4"	22'0"	23'6"	25'2"	26'8"	28'4"	30'0"	31'6"	33'2"
18"	17"	3'0"	4'6"	6'2"	7'8"	9'4"	11'0"	12'6"	14'2"	15'8"	17'4"	19'0"	20'6"	22'2"	23'8"	25'4"	27'0"	28'6"	30'2"	31'8"	33'4"
19"	18"	3'2"	4'8"	6'4"	8'0"	9'6"	11'2"	12'8"	14'4"	16'0"	17'6"	19'2"	20'8"	22'4"	24'0"	25'6"	27'2"	28'8"	30'4"	32'0"	33'6"
20"	19"	3'4"	5'0"	6'6"	8'2"	9'8"	11'4"	13'0"	14'6"	16'2"	17'8"	19'4"	21'0"	22'6"	24'2"	25'8"	27'4"	29'0"	30'6"	32'2"	33'8"
20"	20"	3'6"	5'2"	6'8"	8'4"	10'0"	11'6"	13'2"	14'8"	16'4"	18'0"	19'6"	21'2"	22'8"	24'4"	26'0"	27'6"	29'2"	30'8"	32'4"	34'0"

CONSTANTS FOR DETERMINING CHORDAL PITCH AND RADIUS OF SPUR GEARS.

P = PITCH OF TEETH

R = RADIUS OF PITCH CIRCLE

N = NUMBER OF TEETH.

C = CONSTANT (SEE TABLE BELOW)

$$P = \frac{R}{C}$$

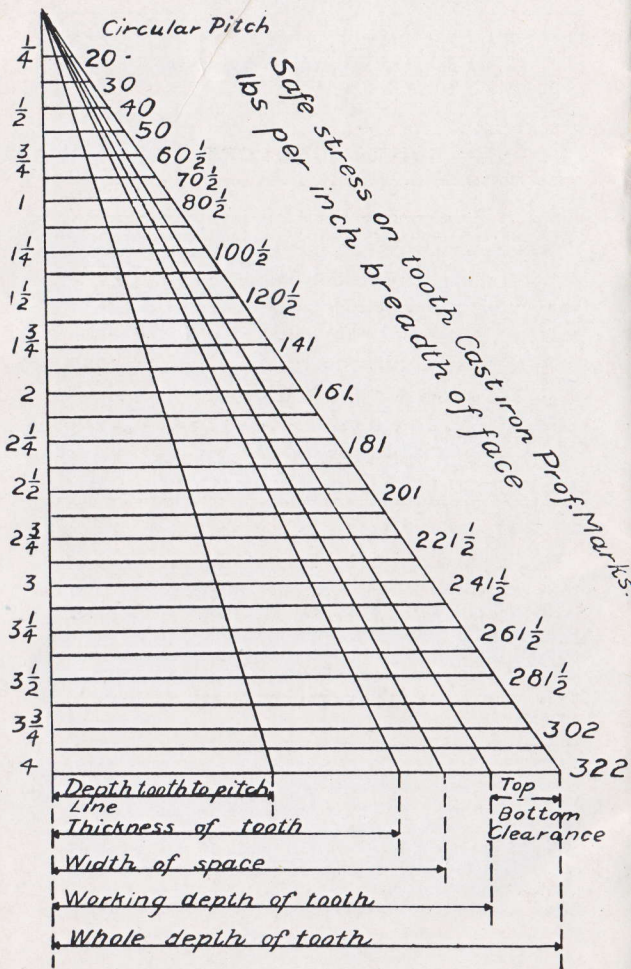
$$R = C \times P$$

$$C = \frac{R}{P}$$

No.	0	1	2	3	4	5	6	7	8	9
0	0.000	0.159	0.318	0.477	0.636	0.795	0.955	1.114	1.273	1.432
10	1.591	1.750	1.910	2.069	2.229	2.387	2.546	2.706	2.865	3.024
20	3.183	3.342	3.501	3.661	3.820	3.979	4.138	4.297	4.457	4.616
30	4.775	4.934	5.093	5.252	5.412	5.571	5.730	5.889	6.048	6.208
40	6.367	6.526	6.685	6.844	7.003	7.163	7.322	7.481	7.640	7.799
50	7.959	8.118	8.277	8.436	8.595	8.754	8.914	9.073	9.232	9.391
60	9.550	9.709	9.869	10.028	10.187	10.346	10.505	10.665	10.824	10.983
70	11.142	11.301	11.460	11.620	11.779	11.938	12.097	12.256	12.416	12.575
80	12.734	12.893	13.052	13.211	13.371	13.530	13.689	13.848	14.007	14.167
90	14.326	14.485	14.644	14.803	14.962	15.122	15.281	15.440	15.599	15.758
100	15.918	16.077	16.236	16.395	16.554	16.713	16.873	17.032	17.191	17.350
110	17.509	17.668	17.828	17.987	18.146	18.305	18.464	18.624	18.783	18.942
120	19.101	19.260	19.419	19.579	19.738	19.897	20.056	20.215	20.376	20.534
130	20.693	20.852	21.011	21.170	21.330	21.489	21.648	21.807	21.966	22.166
140	22.285	22.444	22.603	22.762	22.921	23.081	23.240	23.399	23.558	23.717
150	23.877	24.036	24.195	24.354	24.513	24.672	24.832	24.991	25.150	25.309
160	25.468	25.627	25.787	25.946	26.105	26.264	26.423	26.583	26.742	26.901
170	27.060	27.219	27.378	27.538	27.697	27.856	28.015	28.174	28.334	28.493
180	28.652	28.811	28.970	29.129	29.289	29.448	29.607	29.766	29.929	30.085
190	30.242	30.403	30.562	30.721	30.880	31.040	31.199	31.358	31.517	31.676
200	31.830	31.989	32.148	32.307	32.466	32.625	32.785	32.944	33.103	33.262
210	33.427	33.586	33.746	33.905	34.064	34.223	34.382	34.542	34.701	34.860
220	35.019	35.178	35.337	35.497	35.656	35.815	35.974	36.133	36.293	36.452
230	36.611	36.770	36.929	37.088	37.248	37.407	37.566	37.725	37.884	38.044
240	38.203	38.362	38.521	38.680	38.839	38.999	39.158	39.317	39.476	39.635
250	39.795									

To make drawings for a gear wheel from the following tables, proceed as follows: Take, for example, a wheel of 27 teeth, of 2 inch pitch. First, find pitch radius by the use of table above by multiplying the constant given for 27 teeth, which is 4.297, by the pitch, or 2 inches, which will give a pitch radius of 8.594 inches. Then, having drawn the pitch radius, find the distance from this radius to top of tooth, (addendum), and from this radius to bottom of tooth, (Root), by use of tables Nos. 6 or 7, and scribe lines for these distances. Then mark off several spaces on the pitch circle, the width of the circular pitch, or in this case 2 inches, and from these points mark the thickness of the teeth, found in tables Nos. 6 and 7. For the radii starting from these points for the faces and flanks of the teeth, and the distances above and below the pitch circle for the centers of same, see table No. 8, the radius for the faces of the teeth, for the gear in this example would be 1.66 inches and the distance **below** the pitch circle for the centers of this radius is .15 inches. The radius for the flanks is 2.72 inches, and the distance **above** the pitch circle for this radius is .62 inches.

Odontograph Scale



GEAR TOOTH PROPORTIONS

	1	2	3	4
Addendum	.30 ^c	.30 ^c	.30 ^c	$1 \div P$
Root	.40 ^c	.40 ^c	.35 ^c	$1.157 \div P^{T^0} 1.125 \div P$
Wkg dpth of tooth	.60 ^c	.60 ^c	.60 ^c	$2 \div P$
Total dpth of tooth	.70 ^c	.70 ^c	.65 ^c	$2.157 \div P$
Clearance	.10 ^c	.10 ^c	.05 ^c	$.157 \div P^{T^0} .125 \div P$
Thickness of tooth	.45 ^c	.475 ^c	.485 ^c	$1.51 \div P^{T^0} 1.57 \div P$
Width of space	.55 ^c	.525 ^c	.515 ^c	$1.63 \div P^{T^0} 1.57 \div P$
Backlash	.10 ^c	.05 ^c	.03 ^c	$.12 \div P^{T^0} 0$

COLUMN
I

FOR ROUGH CAST GEARS

COLUMN
II

FOR BETTER CLASS OF GEARS

COLUMN
III

FOR CUT GEARS

COLUMN
IV

FOR DIAMETRAL PITCH OF CUT GEARS

C

FOR CIRCULAR PITCH

P

FOR DIAMETRAL PITCH

THE IMPROVED WILLIS ODONTOGRAPH.

EPICYCLOIDAL TEETH INTERCHANGEABLE TEETH

WELVE TO RACK.

NUMBER OF TEETH IN THE GEAR	For One Pitch Diametral Pitch for any other pitch divide by that pitch				For One Inch Circular Pitch. for any other pitch multiply by that pitch			
	Faces		Flanks		Faces		Flanks	
	Rad.	Dis.	Rad.	Dis.	Rad.	Dis.	Rad.	Dis.
EXACT. INTERVAL								
12	2.30	.15	.00	.00	.73	.05	.00	.00
13 $\frac{1}{2}$	2.35	.16	15.42	10.25	.75	.05	4.92	3.26
15 $\frac{1}{2}$	2.40	.17	8.38	3.86	.77	.05	2.66	1.24
17 $\frac{1}{2}$	2.45	.18	6.43	2.35	.78	.06	2.05	.75
20	2.50	.19	5.38	1.62	.80	.06	1.72	.52
23	2.55	.21	4.75	1.23	.81	.07	1.52	.39
27	2.61	.23	4.31	.98	.83	.07	1.36	.31
33	2.68	.25	3.97	.79	.85	.08	1.26	.26
42	2.75	.27	3.69	.66	.88	.09	1.18	.21
58	2.83	.30	3.49	.57	.90	.10	1.10	.18
97	2.93	.33	3.30	.49	.93	.11	1.05	.15
290	3.04	.37	3.18	.42	.97	.12	1.01	.13

U. S. WEIGHTS AND MEASURES

LONG MEASURE (Measures of Length)

Ins	Feet	Yards	Fath.	Rods	Furl.	Mile
12 =	1					
36 =	3	= 1				
72 =	6	= 2	= 1			
198 =	16½	= 5½	= 2¾	= 1		
7920 =	660	= 220	= 110	= 40	= 1	
63360 =	5280	= 1760	= 880	= 320	= 8	= 1

6080.26 Feet = 1.15 Statute Miles = 1 Nautical Mile or Knot.

SQUARE MEASURE (Measures of Surface)

Sq. Ins.	Sq. Feet	Sq. Yards	Sq. Rods	Roods	Acre
144 =	1				
1296 =	9	= 1			
39204 =	272¼	= 30¼	= 1		
1568160 =	10890	= 1210	= 40	= 1	
6272640 =	43560	= 4840	= 160	= 4	= 1

640 Acres = 1 Square Mile.

An Acre = a square whose side is 69.57 Yards or 208.71 Feet.

CUBIC MEASURE (Measures of Volume)

Cu. Ins.	Cu. Feet	Cu. Yard
1728 =	1	
46656 =	27	= 1

A Cord of Wood = 128 Cubic Feet, being 4 feet × 4 feet × 8 feet

42 Cubic Feet = a Ton of Shipping.

1 Perch of Masonry = 24¾ Cubic Feet, being 16¼ feet × 1½ feet × 1 foot.

LIQUID OR WINE MEASURE

The U. S. Standard Gallon measures 231 Cubic Inches, or 8.33888 Pounds Avoirdupois of pure water, at about 39.85 degrees Fahr., the Barometer at 30 Inches.

Gills	Pints	Quarts	Gallons	Tierces	Hogsheads	Puncheons	Pipes	Tun	Cubic Inches
4 =	1 =								28.375
8 =	2 =	1 =							57.75
32 =	8 =	4 =	1 =						231.
1344 =	336 =	168 =	42 =	1					
2016 =	504 =	252 =	63 =	1½ =	1				
2488 =	672 =	336 =	84 =	2 =	1½ =	1			
4032 =	1008 =	504 =	126 =	3 =	2 =	1½ =	1		
8064 =	2016 =	1008 =	252 =	6 =	4 =	3 =	2 =	1	

A Cubic Foot contains 7½ Gallons

The British Imperial Gallon contains 277.27 Cubic inches and = 1.2 U. S. Gallons.

U. S. WEIGHTS AND MEASURES

DRY MEASURE

The Standard Bushel contains 2150.42 Cubic Inches, or 77.627013 Pounds-Avoirdupois of pure water at maximum density. Its legal dimensions are $18\frac{1}{8}$ Inches diameter inside, $19\frac{1}{8}$ Inches outside, and 8 Inches deep; and when heaped the cone must be 6 Inches high, making a heaped Bushel equal to $1\frac{1}{4}$ struck ones.

Pints	Quarts	Gallons	Pecks	Bushels	Cubic Inches.
2 =	1 =				67.2
8 =	4 =	1 =			268.8
16 =	8 =	2 =	1 =		537.6
64 =	32 =	8 =	4 =	1 =	2150.42

The British Imperial Bushel contains 2218.2 Cubic Inches and = 1.08 U. S. Bushels.

AVOIRDUPOIS OR COMMERCIAL WEIGHT

The Grain is the same in Troy, Apothecaries and Avoirdupois Weights.

The Standard Avoirdupois Pound is the weight of 27.7015 Cubic Inches of distilled water weighed in the air at 35.85 degrees Fahr., Barometer at 30 Inches. 27.343 Grains = 1 Drachm.

Drachms	Ozs.	Lbs.	Long Qrs.	Long Cwt.	Long Ton
16 =	1				
256 =	16 =	1			
7168 =	448 =	28 =	1		
28672 =	1792 =	112 =	4 =	1	
573440 =	35840 =	2240 =	80 =	20 =	1

The above Table gives what is known as the Long Ton. The Short Ton weighs 2000 Pounds.

TROY WEIGHT

For Gold, Silver and Precious Metals.

Grains	Dwts.	Ozs.	Lbs.
24 =	1		
480 =	20 =	1	
5760 =	240 =	12 =	1

175 Pounds Troy = 144 Avoirdupois.

Pounds Avoirdupois X .82286 = Pounds Troy.

Pounds Troy X 1.2153 = Pounds Avoirdupois.

The Jewelers' Carat is equal in the United States, to 3.2 Grains; in London, to 3.17 Grains; in Paris, to 3.18 Grains.

APOTHECARIES WEIGHT

United States and British.

In Troy and Apothecaries Weights, the Grain, Ounce and Pound are the same.

Grams	Scruples	Drachms	Ozs.	Lbs.
20 =	1			
60 =	3 =	1		
480 =	24 =	8 =	1	
5760 =	288 =	96 =	12 =	1

